

WHAT IS CLAIMED IS:

1. A diffractive optical element made of at least two materials of different dispersions, and including at least two diffraction gratings 5 being accumulated one upon another, characterized in that:

each diffraction grating is formed on a curved surface of a substrate; and that a diffraction grating, of said at least two 10 diffraction gratings, in which a curvature radius of the curved surface and a curvature radius of a grating surface in a portion where a grating pitch is largest, have different signs, is one of said at least two diffraction gratings which 15 has a smallest grating thickness.

2. A diffractive optical element according to Claim 1, wherein said diffraction grating having a smallest grating thickness is 20 structured so that an angle which is defined between the grating surface and a grating edge of that diffraction grating is obtuse more than an angle which is defined between the grating surface and a normal to the surface at a position 25 where a plane connecting grating free ends of the smallest-thickness diffraction grating and the grating surface intersect with each other.

3. A diffractive optical element
according to Claim 1 or 2, wherein the grating
edge of the diffraction grating is made in
5 parallel to an optical axis.

4. A diffractive optical element
according to Claim 2 or 3, wherein the curvature
of the plane connecting the grating free ends is
10 approximately even, in each diffraction grating
of said at least two accumulated diffraction
gratings.

5. A diffractive optical element
15 according to any one of Claims 1 - 4, wherein at
least one of said at least two diffraction
gratings is formed at an interface of two
different materials having different
dispersions.

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6. A diffractive optical element
according to any one of Claims 1 - 5, wherein said
at least two accumulated diffraction gratings are
bonded with each other in a non-grating region.

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7. A diffractive optical element
according to any one of Claims 1 - 6, wherein said

at least two diffraction gratings include at least one grating of a shape in which a direction of the grating thickness is different.

5 8. A diffractive optical element according to any one of Claims 1 - 7, wherein said diffractive optical element is effective to improve a diffraction efficiency of a predetermined order, over a whole visible light
10 region of a used wavelength.

9. A diffractive optical element according to any one of Claims 1 - 8, wherein there is a wavelength included in the used wavelength
15 range which wavelength satisfies the following relation:

$\pm (n_{01}-1)d_1 \pm (n_{03}-1)d_2 \pm (n_{02}-1)d_2 = m\lambda_0$
where n_{01} is a refractive index of the material of a first diffraction grating with respect to a wavelength λ_0 , n_{02} is a refractive index of the material of a second diffraction grating with respect to the wavelength λ_0 , n_{03} is a refractive index of the material of a third diffraction grating with respect to the wavelength λ_0 , d_1 and d_2 are thicknesses of the first and second diffraction gratings, and m is a diffraction order.

10. A diffractive optical element
according to any one of Claims 1 - 9, wherein the
substrate has a lens function.

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11. A diffraction optical system including
a diffractive optical element as recited in any
one of Claims 1 - 10.

10 12. A diffraction optical system according
to Claim 11, wherein said optical system is an
imaging optical system.

15 13. A diffraction optical system according
to Claim 12, wherein said diffractive optical
element is provided at one of a lens cemented
surface and a lens surface, or inside a lens.

20 14. A diffraction optical system according
to Claim 11, wherein said optical system is an
observation optical system.

25 15. A diffraction optical system according
to Claim 14, wherein said diffractive optical
element is provided at a side of a lens,
constituting the observation optical system,
which faces an objective lens side thereof.